**NATURAL RESOURCES CONSERVATION SERVICE**

**CONSERVATION PRACTICE STANDARD**

# MONITORING WELL

**(No.)**

**CODE 353**

## DEFINITION

A well designed and installed to obtain representative ground water quality samples and hydrogeologic information from an aquifer.

## PURPOSE

To provide controlled access for sampling ground water near an agricultural waste storage or treatment facility in order to detect seepage and monitor the effects of contaminants in seepage on ground water quality.

## CONDITIONS WHERE PRACTICE APPLIES

This practice applies to the design, installation, and development of monitoring wells where

- Contamination of ground water from an agricultural waste storage or treatment facility is a concern
- The facility is a component of an agricultural waste management system

This practice does **not** apply to:

- Methods for the collection and analysis of ground water samples or ground water information from the well
- Monitoring of subsurface waters in the vadose zone
- The installation of wells for any other purpose
- Temporary exploratory drill holes or borings
- The decommissioning of monitoring wells

## CRITERIA

**Laws and Regulations.** Monitoring wells shall be planned, designed, constructed, operated and maintained in a manner that meets all applicable federal, state, and local laws, rules and regulations.

**Hydrogeologic Investigation.** Prior to the design of a monitoring well, a surface and subsurface investigation shall be conducted to develop a conceptual hydrogeologic model of the site, to identify potential ground water flow paths, and to determine the location of the target monitoring zone(s).

The hydrogeologic investigation shall include the mapping, identification and description of soil and rock masses that affect the movement and transport of subsurface water occurring within at least 100 feet of the perimeter of the facility of interest.

The hydrogeologic investigation shall identify and describe all characteristics and properties of geologic units that can influence subsurface water flow paths or produce preferred flow paths such as karst development, joint sets, fracture systems, faults, lineaments, and other similar discontinuities. These shall be located on a geologic evaluation map of the site.

The hydrogeologic investigation shall identify and describe any tile lines, subsurface drains, surface drains, irrigation ditches, irrigation wells, water supply wells, septic drain fields, infiltration strips, subsurface quarries, mines, or other water control/management related features that have the potential to alter the native subsurface water flow paths. Such features shall be located on a geologic evaluation map of the site.

The hydrogeologic investigation shall be of sufficient detail to map the potentiometric surface to a one-foot contour interval. The map of the potentiometric surface shall be used to determine the hydraulic gradient and direction of flow within the target monitoring zone(s).

The hydrogeologic investigation shall identify and describe any seasonal changes in the potentiometric surface and direction of subsurface water flow paths.

The hydrogeologic investigation shall identify and describe other features that influence subsurface water flow such as hard pans, sand boils, animal burrows, seasonal desiccation, high shrink/swell soils, dense till, depth of frost line, and permafrost.

**Layout.** Monitoring wells shall be located both up gradient and down gradient of the waste storage facility and at a distance and depth based on the results of the hydrogeologic investigation of the site.

The placement of monitoring wells in fractured-rock and karst aquifers shall be based on the location of zones of high-permeability even if they are located offsite.

A minimum of one monitoring well shall be placed on the up gradient side of the waste storage facility and a minimum of three monitoring wells shall be placed down gradient.

When seasonal changes in the direction of subsurface water flow are possible, monitoring wells shall be placed in such a manner as to capture both up gradient and down gradient flow during any time of year.

The layout of the monitoring wells shall be based on the conceptual hydrogeologic model to intercept representative subsurface water flow path(s) of the target monitoring zone(s).

**Design.** The design of all components of the monitoring well shall conform to ASTM D 5092, “Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers” for granular aquifers or to ASTM D 5717, “Standard Guide for Design of Ground Water Monitoring Systems in Karst and Fractured-Rock Aquifers” for karst or fractured-rock aquifers.

**Materials.** Materials used for the construction of monitoring wells shall be non-reactive with subsurface water and shall not leach substances into the subsurface water.

Materials shall be free of contaminants prior to installation.

Well screens shall be made by machine.

All joints shall be threaded. Glued or solvent welded joints shall not be used.

Materials shall have adequate strength to withstand the forces of installation and development.

**Installation.** Installation methods shall be selected based on site-specific conditions.

Installation methods shall be in conformance with ASTM D 5092 for granular aquifers, and ASTM D 5717 for karst and fractured rock aquifers.

The equipment used shall be capable of creating a stable, open, vertical borehole for installation of the monitoring well.

**Well Protection.** Installation of measures to protect the monitoring well from damage from hazards such as frost action, surface drainage, animal or equipment traffic, and lack of visibility shall conform to ASTM D 5092.

Positive surface drainage away from the well heads shall be established.

Protection from natural or human caused damage shall be provided in conformance with ASTM D 5787, “Standard Practice for Monitoring Well Protection.”

A buffer zone with a minimum radius of 30 feet shall be established around each well head. The buffer zone shall be fenced or otherwise protected from access by motor vehicles and livestock.

Within the buffer zone there shall be no storage, handling, mixing, or application of fertilizers, pesticides or other agricultural chemicals or cleaning of equipment used in the handling or application of such items.

**Development.** The monitoring well shall be developed to improve the hydraulic communication between the target hydrogeologic unit and the well screen, to minimize the interference of sediment with water quality samples, and to restore the ground water properties disturbed by the drilling process.

Well completion shall ensure that only the targeted hydrogeologic unit contributes to the monitoring well and that the annular space is sealed to prevent cross contamination from other water sources.

The well development method shall be selected from alternatives provided in ASTM D 5092. The selection of the method shall be based on the physical characteristics of the target hydrogeologic unit and the drilling method used.

For granular aquifers, well completion shall conform to ASTM D 5521, "Standard Guide for Development of Ground Water Monitoring Wells in Granular Aquifers."

For fractured-rock and karst aquifers, well completion shall conform to ASTM D 5717.

**Record Keeping.** Record keeping shall conform to:

- ASTM D 5254, "Standard Practice for Minimum Set of Data Elements to identify Ground Water Site"
- ASTM D 5408, "Standard Guide for Set of Data Elements to Describe a Ground Water Site: Part One – Additional Identification Descriptors"
- ASTM D 5409, "Standard Guide for Set of Data Elements to Describe a Ground Water Site: Part Two – Physical Descriptors"

Installation of monitoring wells shall be reported as required by local or state laws and regulations.

## CONSIDERATIONS

Consider using geophysical tools in conjunction with penetrative exploratory techniques to improve and refine the mapping of the location, shape, orientation, and extent of subsurface hydrogeologic units.

Consider effects of geomorphic processes, geologic structures, regional stratigraphy, and soil and rock properties on subsurface flow patterns when developing a conceptual hydrogeologic model.

Consider the physical properties and methods of movement in the environment of the solutes and pollutants of interest when designing monitoring wells.

Consider installing additional monitoring wells at other points as dictated by the results of the hydrogeologic investigation to adequately monitor the location and direction of movement of any potential contaminant plume.

Consider evaluating alternative drilling methods for installing monitoring wells provided in ASTM D 6286, "Standard Guide for Selection of Drilling Methods for Environmental Site Characterization."

Where frost heave is a concern, consider design alternatives that reduce the potential for frost heave to damage the monitoring well.

## PLANS AND SPECIFICATIONS

Plans and specifications for constructing, installing, developing, and completing monitoring wells shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

## OPERATION AND MAINTENANCE

Provisions shall be made for operation and maintenance (O&M) requirements in keeping with the purpose of this standard.